

Project Description (Attachment 4)

Sunset Gap Seawater Intrusion Assessment

Preventing seawater intrusion into the Orange County Groundwater Basin is one of the primary goals of the Orange County Water District (OCWD). Since the early 1900s seawater intrusion has presented a significant challenge to the dual goals of maintaining water quality and maximizing groundwater production in the basin.

There are four erosional ‘gaps’ near the coastal portion of the groundwater basin where the shallow aquifers are in hydraulic connection with saline water. These four gaps are the Talbert, Bolsa, Sunset and Alamitos gaps. The Talbert and Alamitos gaps are the most vulnerable to seawater intrusion. OCWD operates the Talbert Seawater Injection Barrier in the Talbert Gap in Fountain Valley and Huntington Beach. OCWD also helps manage and fund operation of the Alamitos Seawater Intrusion Barrier in the Alamitos Gap in Seal Beach and Long Beach. These injection barriers help control seawater intrusion. This project focuses on the Sunset Gap.

The Sunset Gap is a flat, 3-mile wide, low-lying topographic feature that is bounded by Landing Hill to the northwest and Bolsa Chica Mesa to the southeast. Landing Hill and Bolsa Chica Mesa are erosional remnants of Pleistocene-aged alluvial and marine sediments uplifted by the Newport-Inglewood Fault Zone (NIFZ). In general, offset along the NIFZ forms a significant impediment to seawater intrusion; however, the NIFZ is not a complete seawater barrier, as evidenced by increasing chloride concentrations in wells inland of the fault zone.

The Sunset Gap Seawater Intrusion Assessment project will identify the direction and rate of movement of saline groundwater, determine the salinity concentration in specific aquifers, provide a baseline from which future salinity changes can be measured, and provide data needed to evaluate the feasibility of seawater intrusion control alternatives.

Seawater intrusion negatively affects groundwater quality and may reduce the availability of local groundwater supplies. This project is necessary to delineate the extent and monitor trends of seawater intrusion and collect data needed to assist in future seawater management control. OCWD considers the delineation of the vertical and lateral extent of seawater intrusion in the Sunset Gap as a top priority, given that one Huntington Beach well was shut down due to elevated salinity. Two other nearby Huntington Beach wells have also shown signs of saline groundwater impact.

Four multi-depth monitoring wells are proposed in the Sunset Gap on Naval Weapons Station Seal Beach (NWSSB) (***Attachment A “Proposed Sunset Gap Monitoring Well Location Map”***).

The objectives of these wells are as follows:

- Identify the direction and rate of movement of saline groundwater
- Determine the salinity concentration in specific aquifers
- Provide a baseline from which future salinity changes can be measured
- Provide data needed to evaluate the feasibility of seawater intrusion control alternatives.

The wells will be constructed of five 4-inch diameter PVC casings installed in a single borehole drilled using reverse rotary equipment. Each casing will have a 20-foot long screen installed to monitor water levels and quality at a specific depth.

The data to be collected through the project include:

- Geologic and geophysical logs from each of the four boreholes
- Groundwater elevation data from each of the individual wells (estimated to be five casings per well, for a total of 20 monitoring points)
- Water quality data from the 20 monitoring points. Water quality analyses will be conducted by OCWD's state-certified Water Quality Laboratory. Selected measurements will be made in the field.
 - Temperature, pH, electrical conductance, dissolved oxygen (field parameters)
 - Total dissolved solids (TDS)
 - General minerals (chloride, etc...)
 - Nitrate, nitrite, ammonia, phosphate
 - Volatile organic compounds (VOCs)

The California Department of Water Resources (1968) documented the hydrogeology and seawater intrusion in the Sunset Gap; however, this is the least hydrogeologically-characterized of the four coastal gaps in the basin. Few wells exist at the vast NWSSB that are deep enough to determine groundwater flow direction or monitor seawater intrusion.

Based on available data, OCWD staff believes that saline water occurs in the Beta aquifer at a depth of approximately 260 to 300 feet bgs in the vicinity of the Huntington Beach wells that have shown indications of seawater intrusion. High chloride levels in Huntington Beach Well No. 12 are suspected to be the result of seawater intrusion. Other aquifers may also be affected by salinity. Potential origins of the seawater intrusion in Sunset Gap include the Huntington Harbor area, Anaheim Bay tidal inlets, and the Alamitos Gap/Landing Hill area. TDS concentrations range from less than 250 milligrams per liter (mg/L) in wells unaffected by seawater intrusion to over 20,000 mg/L in wells near Huntington Harbor.

OCWD commissioned a geophysical survey consisting of 20 high-resolution resistivity soundings along four survey lines and ten Time Domain Electromagnetic Induction (TEM) soundings along two profile lines was conducted between January and March, 2010 at the NWSSB. The survey was conducted to help OCWD determine the location and extent of saltwater intrusion into the Sunset Gap, an area where the major aquifers may be exposed to seawater.

Saltwater intrusion was found to be extensive in the western portion of the study area in the Semi-Perched, Alpha, Beta, Lambda, and Omicron aquifers. Saltwater intrusion was extensive in the southeastern portion of the Semi-Perched aquifer. On the eastern half of the site, the Alpha, Beta, Lambda and Omicron aquifers were found to primarily contain fresh to brackish water with narrow plumes of brackish to saline water trending northward from the southern edge of the site. The Omicron aquifer was found to contain primarily fresh water in the southeastern portion of the site. Limited investigation of the Main aquifer suggests that it contains generally fresh water in the area surveyed by the TEM soundings.

The results of the geophysical surveys conducted for this project provide a significant amount of information on the subsurface geology of the area and the distribution of saline and brackish water in the major aquifers. Based on the information provided by the geophysical surveys several broad conclusions can be reached:

- The Semi-Perched aquifer appears to contain saline water over most of the study area with the exception of a portion of the northeastern corner of the site that appears to have fresh water.
- The Alpha aquifer appears to contain saline water on the western portion of the study area. In the eastern portion of the study area, the aquifer contains primarily fresh water with an apparent plume of brackish water trending from the southeast corner of the study area northward across the site.
- The Beta aquifer appears to contain saline water on the southwestern portion of the study area with pockets of fresh to brackish water along the northwest edge of the site. In the southeastern portion of the study area, the aquifer contains primarily fresh water with an apparent plume of more brackish water trending from the southeast corner of the study area to just north of Bolsa Drive on the eastern edge of the site. A larger mass of more brackish water appears to be present in the northeast corner of the site.
- The Lambda aquifer appears to contain saline water on the southwestern portion of the study area with pockets of fresh to brackish water along the

northwest edge of the site. In the southeastern portion of the study area, the aquifer contains primarily fresh to brackish water with an apparent plume of more brackish water trending from the saline water mass in the southwest portion of the study area northeast to just north of Bolsa.

At the beginning of 2012, OCWD commissioned the construction of two monitoring wells, BS10 and BS11, to provide additional water level and water quality data and permanent monitoring points for the Sunset Gap area in west Orange County. OCWD secured permission from the U.S. Navy to locate the wells at NWSSB. BS10 is located on the south side of Bolsa Avenue about 0.9 mile east of Case Road. BS11 is located on the east side of Case Road about 0.3 mile north of Bolsa Avenue. BS10 and BS11 are the first nested monitoring wells installed at NWSSB by OCWD. The new wells provide aquifer-specific monitoring points in shallow to deep aquifers. Sites for BS10 and BS11 were selected by OCWD to further investigate seawater migration within the shallow to deep aquifers in Sunset Gap.

Monitoring and preventing the encroachment of seawater into fresh groundwater zones along coastal Orange County is a major basin management issue. Seawater encroachment also represents a key factor in determining the basin operating range in terms of the maximum accumulated overdraft. OCWD conducts a comprehensive monitoring program of the groundwater basin and surface water supplies in the watershed to properly manage water supplies and to safeguard the basin's water quality. By identifying the direction and rate of movement of saline groundwater, determining the salinity concentration in specific aquifers, providing a baseline from which future salinity changes can be measured, and providing data needed to evaluate the feasibility of seawater intrusion control alternatives, the Sunset Gap Seawater Intrusion Assessment project supports the groundwater quality objectives of OCWD's critical basin monitoring programs outlined in Section 3 of OCWD's 2009 Groundwater Management Plan (GWMP) and the Water Quality Management goals and objectives outlined in Section 5 of the GWMP.

OCWD holds monthly meetings with the Orange County Groundwater Producers (groundwater producers). The groundwater producers are the professional water managers for the 19 retail water agencies that serve the 2.4 million people within OCWD's service area. The groundwater producers include cities, special districts, and investor-owned utilities that produce more than 90 percent of the water pumped from the basin. The monthly meetings with the groundwater producers routinely address issues impacting water quality, groundwater monitoring, water supply management, and groundwater quality improvement projects. Seawater intrusion at Sunset Gap is an issue that the groundwater producers are aware of, engaged in and are periodically updated on. The groundwater producers have expressed support for the Sunset Gap Seawater Intrusion Assessment project (**Attachment B**). Moreover, the Sunset Gap Seawater Intrusion Assessment project is fully supported by the elected

members of the California Legislature who serve in the area the project will be located in (**Attachment C**).

Data will be compiled and maintained by OCWD. OCWD conducts a comprehensive monitoring program of the groundwater basin to properly manage water supplies and to safeguard the basin's water quality. Ongoing data collection after the end-date of the grant agreement will be managed by OCWD staff. After the well construction is completed and four quarterly samples are collected for the grant-funded work, OCWD will continue to sample the wells. OCWD staff will regularly review the data from the four wells and adjust the sampling frequency as needed. For example, if the water quality or groundwater elevation data show significant variability between samples, OCWD staff will consider increasing the sample frequency to collect data more rapidly.

Routine sampling of the wells will continue for many years through funding provided in OCWD's General Fund. This funding from OCWD will include sample collection, water quality analysis at OCWD's laboratory, data quality assurance and quality control, data entry and data management through OCWD's data management system (WRMS – Water Resources Management System), and routine maintenance on the wells. Financial resources to provide funding come through OCWD's assessment of a fee referred to as the 'Replenishment Assessment'. OCWD's enabling legislation grants OCWD the powers to assess this fee for pumping from the groundwater basin.

In addition to supporting implementation of OCWD's GWMP, the Sunset Gap Seawater Intrusion Assessment also supports implementation of the Integrated Water Management Plan for the Santa Ana River Watershed (SAWPA, 2010). The Santa Ana Integrated Water Management Plan includes a goal of attaining water quality standards and a goal of maintaining salt balance. To meet these goals, the Plan includes strategies and tactics that include protecting good quality groundwater, monitoring, assessment, and reporting. The data collected from the four new monitoring wells in the Sunset Gap will assist in meeting these goals and strategies.

The data collected from the four new monitoring wells constructed in the Sunset Gap Seawater Intrusion Assessment will assist with meeting these policy objectives as follows:

- Provide data to define the geologic stratigraphy and hydrogeologic conditions in the Sunset Gap;
- Provide the basis for evaluating the potential flowpaths of seawater intrusion and thereby prevent degradation of groundwater quality and maintain groundwater quality suitable for beneficial uses;
- Provide data to formulate alternatives to prevent seawater intrusion, to the extent needed.

- By preventing degradation of groundwater quality, the basin's usable storage capacity will be maintained;
- By providing information regarding alternatives to prevent seawater intrusion, it may be possible to prevent seawater intrusion under conditions with greater pumping, thereby increasing the basin's useable storage.

Alternatives to prevent seawater intrusion include:

- Reduced pumping near the coast;
- Construction and operation of a seawater intrusion barrier whereby high quality water is injected to create a hydraulic barrier;
- Construction and operation of a pumping system to depress groundwater elevations such that seawater cannot migrate inland beyond the area of depressed groundwater elevations;
- Construction of an impermeable barrier that prevents migration of seawater due to the low hydraulic conductivity materials in the barrier.

The data from the four new monitoring wells need to be collected and integrated with data from other wells into an updated conceptual model for the Sunset Gap to determine if seawater intrusion poses a threat to water quality in the groundwater basin. If the lateral and vertical extent of seawater intrusion poses a threat to water quality, alternatives will be developed and evaluated. Data from the Sunset Gap Seawater Intrusion Assessment is critical to the determination of whether seawater intrusion threatens water quality and the development of feasible alternatives.

OCWD holds monthly Water Issues Committee and bi-weekly Board of Director meetings where OCWD staff informs and recommends actions to its board of directors on a wide-range of groundwater management issues. The Water Issues Committee and Board of Director meetings are publicly-noticed, open to the public and an agenda and materials for the meetings are posted and available for download on OCWD's website (www.ocwd.com). Seawater intrusion at Sunset Gap and its impact on the groundwater basin have been the subject of reports, updates and action items at OCWD's Water Issues Committee and Board of Director meetings. Based upon OCWD's well-established open and public meeting policy, its public notices, and website postings and participation in regional, state and national stakeholder groups, the general public, state and federal agencies, stakeholders and groundwater users will have ample notice of the project and multiple opportunities to engage OCWD staff and its Board of Directors on the Sunset Gap Seawater Intrusion Assessment project throughout the process.